

# Town of Essex, MA

## Community Resilience Building Workshop

### Municipal Vulnerability Preparedness Program

#### Summary of Findings

June, 2018



*Route 133/Main Street "Essex Causeway", Essex, MA. Winter storm and tidal flooding, March 2, 2018*

Prepared for the Town of Essex  
by the Ipswich River Watershed Association



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- Kristen Grubbs: Environmental Planner, Ipswich River Watershed Association (IRWA), Essex's MVP/CRB provider and lead facilitator
- Sam Cleaves\*: Planner, Metropolitan Area Planning Council (MAPC)
- Liz Duff\*: North Shore Education Coordinator, Mass Audubon
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# Town of Essex Community Resiliency Building Workshop

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# Town of Essex Community Resilience Building Workshop

## Summary of Findings

### 1. Overview

In September 2016, Massachusetts Governor Charlie Baker signed Executive Order 569, instructing the state's government to provide assistance to cities and towns to complete climate change vulnerability assessments and resiliency action plans. The goals of the program are for each town and city across the Commonwealth to gather together a diverse group of community stakeholders to:

- Define top local natural and climate-related hazards of concern;
- Identify existing and future strengths and vulnerabilities;
- Develop prioritized actions for the community;
- Identify immediate opportunities to collaboratively advance actions to increase resilience.

To accomplish these goals, the state's [Municipal Vulnerability Preparedness Program](#) (MVP) was launched in 2017. In the first year, the Town of Essex joined 71 other communities engaged in the MVP program, using local knowledge and community strengths to partner with the Commonwealth. The Town of Essex participated in the primary component of the MVP program by holding a full day Community Resilience Building (CRB) Workshop on April 5, 2018. More information about the CRB process can be found at [www.communityresiliencybuilding.com](http://www.communityresiliencybuilding.com).

### Background and Need for Workshop

The Town of Essex is located 30 miles northeast of Boston along the Massachusetts coast, within the Essex Bay and Ipswich Bay systems of the North Coastal Watershed. The robust coastal economy of the Town of Essex relies heavily on the natural resources of the Essex River and the Great Marsh, the largest contiguous salt marsh in New England, which makes up 22% of the land area of Essex. (MAPC, Town of Essex Hazard Mitigation Plan, 2012). The main downtown area, centered along and near Route 133/Main Street, includes thriving businesses

such as marinas, historic boat building, kayak tours, river cruises, antique shops, seafood restaurants, and more. However, like most coastal communities in Massachusetts, Essex is highly exposed and increasingly sensitive to coastal hazards that are amplified by a rapidly changing climate. The hazards are numerous and include (but are not limited to): coastal flooding from storm surge and sea level rise; salt marsh and riverbank erosion; freshwater flooding caused by heavy precipitation events; winter storms, cold, and snow; extreme heat and drought; and others.



*Essex Causeway/Main Street and businesses showing inundation from the Essex River.  
Photo credit: Abby Manzi, DeRosa Environmental*

To address the threats from coastal forces, the Town of Essex has taken numerous steps over the last several years to reduce its vulnerability and plan for resilience. Working with the National Wildlife Federation and the Ipswich River Watershed Association, the Town of Essex

joined the five other coastal towns bordering the Great Marsh (Salisbury, Newburyport, Newbury, Rowley, and Ipswich) to complete the Great Marsh Resiliency Planning Project and the Great Marsh Barriers Assessment. (These projects were funded by Hurricane Sandy Restoration Funds from the National Fish and Wildlife Foundation.) The final *Great Marsh Coastal Adaption Plan* ([www.greatmarshresiliency.org](http://www.greatmarshresiliency.org)) was completed in December 2017 and includes a town-specific Vulnerability Assessment for Essex, as well as specific adaptation strategies and recommendations for the towns and for the region as a whole. The Great Marsh project also included a thorough review of culverts, bridges, and dams – both coastal and inland – that are vulnerable to climate hazards. The final *Great Marsh Barriers Report*, with identification of vulnerable barriers throughout the town of Essex and 28 other communities was published by the Ipswich River Watershed Association in February, 2018 ([http://www.pie-rivers.org/id\\_20/](http://www.pie-rivers.org/id_20/)).

While Essex has already completed significant work to assess and plan for its coastal hazards, the State of Massachusetts encouraged the community to participate in the MVP program for several additional reasons:

- To use the Community Resiliency Building (CRB) process ([www.communityresiliencebuilding.com](http://www.communityresiliencebuilding.com)), the key element of the MVP program, to engage a new and diverse set of stakeholders across the community;
- To assess and evaluate non-coastal (inland), environmental, public health, and societal vulnerabilities and hazards;
- To work collaboratively with the town's concurrent 2017/2018 Hazard Mitigation update process; and
- To identify and prioritize immediate opportunities to collaboratively advance actions to increase resilience.

### **Workshop Planning Team and Core Partners**

Led by Town Administrator Brendhan Zubricki, the Town of Essex contracted with the Ipswich River Watershed Association to plan and run the Community Resiliency Building Workshop. Because the Town was also in the process of working with the Metropolitan Area Planning Council (MAPC) to complete an update to its 2012 Hazard Mitigation Plan, MAPC staff joined the Essex MVP Planning Team. Additional planning team partners included

regional partners from the Massachusetts Bays/8 Towns & the Great Marsh Committee and Mass Audubon.

The Essex CRB Workshop Planning Team included the following individuals:

- Brendhan Zubricki: Essex Town Administrator
- Kristen Grubbs: Environmental Planner, Ipswich River Watershed Association, Essex's MVP/CRB provider and lead facilitator
- Sam Cleaves\*: Planner, MAPC
- Liz Duff\*: North Shore Education Coordinator, Mass Audubon
- Peter Phippen\*: 8 Towns & the Great Marsh Coastal Coordinator, Massachusetts Bays Program, MA Office of Coastal Zone Management
- Eliza Wallace, PhD: GIS Analyst, MAPC

\* *Small group facilitators for the CRB Workshop*

### **The Workshop Process**

The Town of Essex CRB Workshop was held on Thursday, April 5, 2018, in Essex Town Hall. The day's agenda, attached as Appendix A, is more fully described below.

The Project Planning Team developed the list of invited participants in December, 2017, using local knowledge as well as the suggested CRB stakeholder groups as guidance. An invitation flyer was created (see Appendix B), and email invitations were extended by email to the selected group by Town Administrator Brendhan Zubricki in January, 2018. Appendix C includes the list of invited guests and workshop attendees.

Registration began at 8am on April 5<sup>th</sup>, with a formal welcome by Mr. Zubricki at 8:30am. Lead facilitator Kristen Grubbs gave an overview of the workshop, and introductions were shared by all attendees with each other. Ms. Grubbs then gave a PowerPoint presentation, focusing on climate science and data relevant to the Town of Essex, as well as a summary of past resiliency planning efforts and outcomes, including the Great Marsh Vulnerability Assessment and Adaptation Plan mentioned earlier. The presentation included climate change projections and their current and potential future impacts on Essex. An overview of specific infrastructural, social, and environmental challenges facing the Town due to climate change was provided.

Following the presentation, the full group discussed and answered general questions about the information. Attendees took a short break and then broke into three smaller discussion groups of 10-12 participants, including a facilitator and a note-taker. Groups were pre-determined by the Planning Team to include a diversity of stakeholders and a gender balance. Following the suggested CRB process, the first task of the small groups was to identify the Top Hazards for the community and to use a Risk Matrix to identify the vulnerabilities and strengths of the infrastructural, societal, and environmental features of the community.



*Participants of the Essex Community Resiliency Building Workshop, Essex Town Hall. April 5, 2018*

During the pre-workshop planning, Ms. Grubbs had consulted the Community Resilience Building process founder, [Adam Whelchel](#), to explore how best to incorporate the extensive vulnerability planning and assessment that the Town of Essex had already completed as part of the Great Marsh Resiliency Planning Project. Over the course of multiple email exchanges and a phone call on January 30, 2018, Dr. Whelchel advised the Town of Essex Planning Team that it made sense to use the findings of the Great Marsh Plan to *pre-populate* portions of the CRB Risk Matrix, identifying ahead of time both the four Top Hazards and also the Primary Features for each matrix (Infrastructural, Societal, and Environmental). Preliminary results of the Essex 2017 Hazard Mitigation Plan Update (which the Town of Essex was in the midst of completing with MAPC staff) also supported this effort. The pre-populating of the Risk Matrix was completed by the Planning Team during February and March, such that on the day of the workshop, the attendees were able to review, endorse, and, as needed, supplement the information captured on the Risk Matrix.

The small groups had several additional materials and tools at their tables to help guide discussion of their community's vulnerabilities, including:

- \*Essex Critical Infrastructure map (provided by MAPC)
- \*Essex Natural Resources maps/poster (including data on Terrestrial Resources, Trees, Freshwater Resources, and Coastal Resources that are vulnerable to climate change);
- \*Climate Change poster that summarized climate impacts facing the Town of Essex;
- \*Essex Social Vulnerability poster
- North Coastal Basin summary of temperature and precipitation projections from the MA Climate Clearinghouse data set;
- "The Town of Essex Healthy Aging Community profile" from the Tufts Health Plan Foundation;
- "Ecological Drought in the Northeast United States" compiled by the Northeast Climate Science Center;
- The Town of Essex Vulnerability Assessment excerpted from the *Great Marsh Coastal Adaptation Plan*; and
- Excerpts from the 2012 *Essex Hazard Mitigation Plan* showing the High Priority Hazard Areas.

After reviewing the top hazards and the community features, both vulnerabilities and strengths, the groups added missing features to the Risk Matrix and endorsed the final list. The groups took a short break and then moved directly into identifying Community Actions to address the vulnerabilities and/or protect the strengths of each feature. Additional resources were used to identify actions, including:

- \**“Regional Adaptation Strategies & Recommendations for the Great Marsh Region”* excerpted from *the Great Marsh Coastal Adaptation Plan*;
- *“Town of Essex Adaptation Strategies and Recommendations for Selected Areas of Concern”* excerpted from *the Great Marsh Coastal Adaptation Plan*;
- *“Potential Mitigation Measures”* excerpted from the *2012 Essex Hazard Mitigation Plan*;
- \*National Wildlife Federation’s *“Sample Guide to Climate Adaptation Strategies”*; and
- \*The Nature Conservancy’s *“Guide to Nature-Based Solutions”*.

\* *The asterisked materials are included in Appendix E.*

After actions and strategies to address infrastructural, environmental, and societal vulnerabilities had been compiled, groups began the process of prioritizing the actions and choosing the top three actions for each feature.

Following a lunch break, participants reconvened in a large group and a representative of each small group reported out to the full workshop, presenting a brief summary of their group’s discussion and describing the prioritized actions. The workshop facilitators recorded each group’s top actions onto posters, grouping them into the three categories of environmental, societal, and infrastructural actions.

To facilitate further prioritization, participants were then given nine (9) sticky dots and asked to “vote” on the highest priority actions by placing three dots on their top picks for each feature category. This sticky dot voting resulted in creation of a final prioritized list of actions. Finally, the large group discussed the results and concluded with a list of agreed-upon actions that the Town of Essex should embark upon to increase the resilience of the community in the face of anticipated climate change impacts. The Town Administrator concluded the workshop with some remarks summarizing the recommendations and describing next steps for the community, and the workshop was adjourned.

## 2. Top Hazards

To determine the Top Hazards to be considered during the CRB process, the Town of Essex relied heavily on the extensive previous planning it has completed over the past few years: specifically using the assessments of hazards from the *Great Marsh Coastal Adaptation Plan* (December 2017) (<https://www.nwf.org/greatmarshadaptation>), the *Great Marsh Barriers Report* (February 2018) ([http://www.pie-rivers.org/id\\_20/](http://www.pie-rivers.org/id_20/)), and the *Essex Hazard Mitigation Plan (2012 and 2017 update)* ([http://essexma.org/Pages/EssexMA\\_Selectmen/hazmitplan.pdf](http://essexma.org/Pages/EssexMA_Selectmen/hazmitplan.pdf)). These documents extensively explored the following issues:

- What hazards have impacted Essex in the past? Where, how often, and in what ways?
- What hazards are impacting the town currently? Where, how often, and in what ways?
- What hazards will impact the town in the future?
- What's exposed to hazards and climate threats within your community?

As described within the aforementioned documents, Essex is highly exposed and increasingly sensitive to several natural hazards that will be affected by climate change. As is true for most coastal communities in Massachusetts, the hazards are numerous and include coastal flooding from Nor'easters, winter storms, king tides, and sea level rise; hurricanes and heavy wind; erosion caused by disruptions in sediment transport, hardening of shorelines, and increased wave energy; freshwater flooding caused by severe precipitation events, improperly-sized culverts, and other hydro-barriers; and extreme heat and drought that can cause brush fires, water shortage and stress, and other public health impacts.

The 2012 *Essex Hazard Mitigation Plan* summarized the Town's highest hazards risks as flooding and winter storms; see table below.

**Table 4**  
**Hazard Risks Summary**

Hazard	Frequency	Severity
Flooding	High	Serious
Winter storms	High	Serious
Hurricanes	Medium	Serious - extensive
Earthquakes	Low	Catastrophic
Tornadoes	Low	Extensive
Landslides	Low	Minor
Brush fires	Medium	Minor
Dam failures	N/A	N/A (no dams)

Table 4: Hazard Risks Summary, *Essex Hazard Mitigation Plan (2012)*, page 11.

The Town of Essex Vulnerability Assessment, completed as part of the *Great Marsh Coastal Adaptation Plan*, found that approximately 27% of the town is vulnerable to coastal inundation, depending on the severity of the storm. That number climbs to 30% in 2070. The Town has particularly high exposure to coastal flooding due to its topography, hydrology, and geographic location.

The community's high exposure to coastal flooding has been documented both recently and historically, including the impacts from storms during early January and early March in 2018 (see cover photo), Super Storm Sandy in 2011, the Patriots Day Storm of 2007, the Mother's Day Storm of 2006, and numerous other Nor'easters – particularly those that have occurred during high tides, including King Tides. Warming temperatures bring both more powerful storms and sea level rise. While projections for sea level rise vary dramatically depending on future greenhouse gas emissions, melting ice in the Arctic, ocean currents, and other factors, the northeastern United States, including coastal Massachusetts, can expect to see between 23 and 82 inches of sea level rise by the year 2100. (*Climate Change* poster made for Essex CRB Workshop by MAPC.)

In addition, coastal erosion is a major concern for the Town. During storms, the extensive salt marsh in Essex can help to buffer the community from coastal flooding, but as the salt marsh health declines from sea level rise and erosion, the community will be more exposed. Both residents and scientists have witnessed significant rates of marsh bank erosion in Essex Bay in recent years. According to researcher Alyssa Novak, these changes have been attributed to: “1) waves eroding banks; 2) sea-level rise increasing water logging; 3) eutrophication decreasing plant investment into belowground biomass; and 4) hyper-abundant green crabs destabilizing banks through the creation of burrows.” For instance, at one of the sites being monitored by Boston University, the marsh receded 4.57 meters (15 ft.) between the summer of 2014 and May 2015 alone, with erosion continuing in 2016 and 2017. (“Marsh Edge Erosion,” Boston University, accessed August 2015, <http://sites.bu.edu/novak/research/marsh-edge-erosion/>). Climate changes, such as sea level rise, only act to exacerbate and accelerate erosion concerns.

In addition to coastal flooding, riverine and inland flooding is a concern for Essex. The *Great Marsh Barriers Report* assessed 17 non-tidal stream crossings in the town, particularly focusing on culverts that are barriers to the natural flow of streams and rivers. The screening tools identified those structures that are less likely to function properly during high flows due to

being undersized relative to the upstream watershed or mismatched to the natural stream bed. With climate change bringing more extreme precipitation events to the northeastern United States (more frequent storms with larger amounts of rainfall), causing higher and heavier volumes of stormwater runoff, the impact of inland flooding on infrastructure, as well as the society, will become even more significant for Essex.

Additionally, predictions of temperature changes resulting from climate change show that both extreme cold in the winter and extreme heat in the summer will be in Essex's future. The winter of 2018 brought record cold temperatures in January. Winter Storm Grayson on January 4, 2018, was one of the most intense western Atlantic winter storms in decades, clobbering the East Coast with blizzard conditions and major coastal flooding. High winds triggered power outages, white-outs, and road closures throughout the Eastern seaboard, including Essex.

The summer of 2016 saw "extreme drought conditions" for the first time in the Massachusetts Drought Monitor's record. Currently, the Town of Essex sees 0.04 days with temperatures over 100 degrees F; by the end of the century there may be as many as 12 days over 100 degrees. In addition, the projected change in annual consecutive dry days goes from 17 to nearly 20 days (MA Climate Change Clearinghouse).

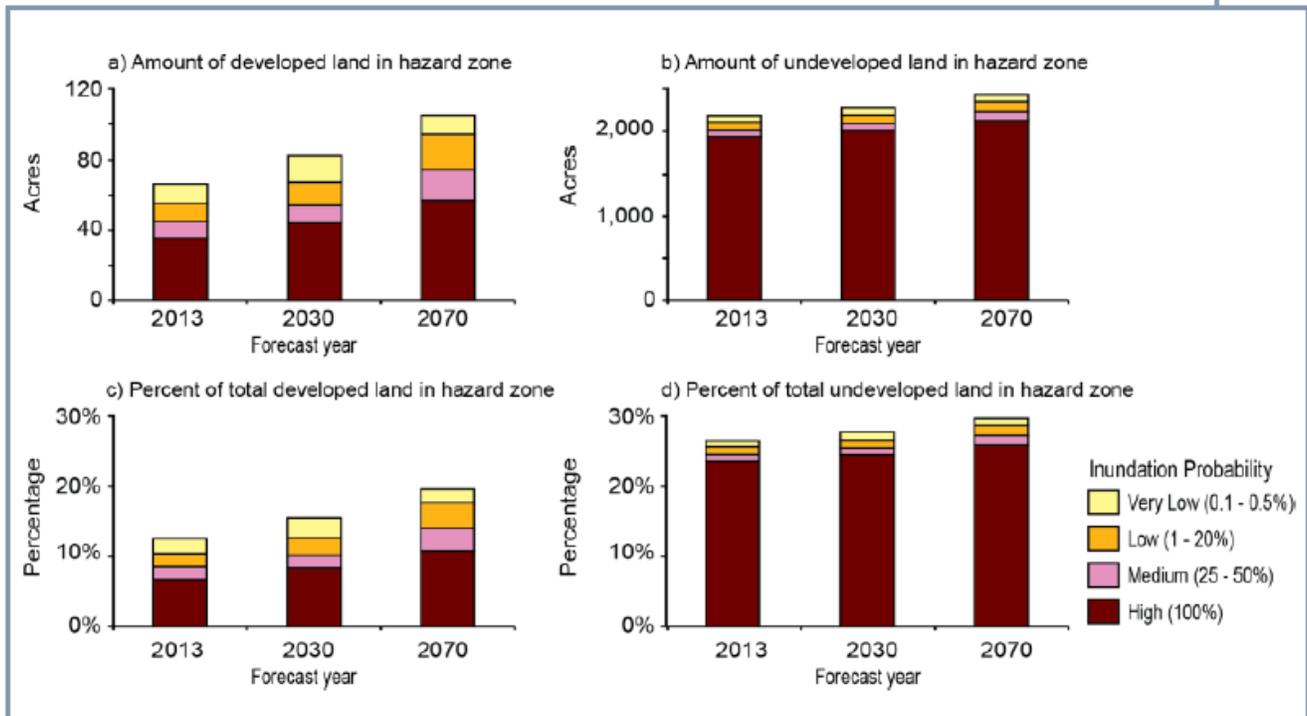
Using all of this extensive previous work and current data from the MA Climate Change Clearinghouse to identify the town's past, current, and future hazards, the Core Planning Team determined the following top hazards for the town. These Top Hazards were confirmed and endorsed by the CRB attendees during the workshop.

**Top Hazards for the Town of Essex:**

- **Coastal Storm Surge & Sea Level Rise**
- **Inland Flooding**
- **Extreme Cold/Winter Storms**
- **Heat/Drought/Fire**

### 3. Top Areas of Concern

During the Essex Community Resiliency Building Workshop, participants overwhelmingly agreed that the top areas of concern were those community assets affected by the impacts of coastal flooding. A significant portion of the area subject to coastal inundation in Essex is developed land, including land that is subject to nearly annual or semi-annual flooding, both now and in the future. (See figure below.)



Amounts of (a) developed and (b) undeveloped land and total percentages of (c) developed and (d) undeveloped land in coastal hazard zones of Essex, Massachusetts, expressed by inundation probability in 2013 (present day), 2030, and 2070. *Great Marsh Coastal Adaptation Plan, December 2017, page 109.*

(Abdollahian, N. et al., *Community exposure to potential climate-driven changes to coastal-inundation hazards for six communities in Essex County, Massachusetts*, U.S. Geological Survey open-file report (Reston, VA: USGS, 2016).

Because of the fact that a significant amount of the infrastructure in Essex is located in low-lying areas that currently flood, the community will be even more susceptible to flooding from storm surge and sea level rise as the climate changes. Overall 43% of Essex falls within the FEMA 1% flood zone (often referred to as the “100-year” flood zone), including the Essex

downtown, the economic center which includes a major transportation corridor (the Route 133 Causeway) and numerous businesses, marinas, and restaurants.

**Infrastructural Features:** During the Great Marsh Resiliency Planning Process, certain assets were identified, by the Essex Municipal Task Force and the project's coastal inundation modeling and socioeconomic analysis, as "Vulnerable Areas of Special Concern" due to their current and future vulnerability and the consequences if the area or feature is impacted by flooding or erosion (See *Great Marsh Coastal Adaptation Plan*, Appendix C). These assets included the following:

- **Route 133/Main Street Causeway & Woodman's Landing** - tidal and storm-driven flooding; flooding occurring from both sides of the road; flooded road cuts off emergency services and impacts store-front economy. Estimated 16,000 cars drive the Essex Causeway each day. When road is closed, traffic must use Apple Street, resulting in businesses suffering from lack of traffic and access. The detour has major impacts to this primary regional transportation corridor.
  - In particular, the Main Street Bridge over the Essex River was identified as a concern. The bridge was impacted severely by the freezing cold and ice of Winter Storm Grayson in January, 2018. MA Dept of Transportation owns the bridge and is in the process of repairing and rebuilding.
- **Eastern Avenue at Ebben Creek** - road is in 100-year floodplain; highly vulnerable to 6' sea level rise; flow is being restricted by culvert; flooding impacts health of the salt marsh, causing erosion and scouring; stability of road could be threatened.
- **Conomo Point Road & Robbins Road** - low-lying portions of road flood and flooded road blocks access to homes, emergency access, boat launches, and clamming/recreation areas; additionally, seawalls and other structures are affected by storm surge.
- **Eastern Avenue and Grove Street** – flooding at the intersection, tidal culvert
- **Richdale's Gas Station on Main Street** - high exposure to flooding; potential for gas spill that would impact wider community as well as natural resources; critical sewer pump station right behind Richdale's (see below)
- **Landing Road Culvert** – flooding at culvert where Alewife Brook passes beneath road
- **Apple Street** – Apple St. is the alternate route for traffic when the Main St. Causeway is closed, however it regularly floods at low spots during storms. According to workshop participants, the street was underwater by two feet during the January, 2018 storms.

Apple St. flooding as well as winter storm damage impacts travel; the winding road is not easily passable in winter conditions and trees in the right of way often fall during storms cutting off access. Flooding is a high concern at the Apple St. culvert near Andrews St.

The *Great Marsh Barriers Report* identified two additional culverts as highly vulnerable infrastructure:

- **Crossing at Lufkin Street** - high priority, unable to pass flow at a 2-year (50%) storm; risk to road and private homes
- **Crossing at Story St/Western Ave** - high priority (in top 35 of all 1000+ culverts assessed in 29 towns in region) for both hydrological and ecological risk

The *2012 Essex Hazard Mitigation Plan* identified a total of 31 structures that have a 1% annual chance of flooding according to FEMA flood zones, of which seven are regarded as *critical infrastructure*: the Department of Public Works Barn, Essex Town Hall, 2 water pump stations, a water tank, the Tennessee gas line pump station, and a fire tower. Additional vulnerable infrastructure according to the *Hazard Mitigation Plan* and the Workshop participants' discussion include:

- **Water Lines and Hydrants** – To assure fire protection, there is a documented need for water line replacement and upgrades, particularly the interconnection with Gloucester
- **Water Supply** - The Town of Essex's water is supplied by three gravel packed wells, one on Centennial Grove Road and two on Harry Homans Drive - all are near Alewife Brook and Chebacco Lake. 2/3 of town gets water from the public supply. 1/3 town has private wells (approximately 1200 residences). Drought may impact both public water sources and private wells. Sea level rise may cause saltwater intrusion to private wells that are located in low-lying coastal areas.
- **Conomo Point seawall system** – Erosion issues at the mouth of the Essex River have directed tidal and storm energy to Conomo Point in a way that Essex has not seen before. As a result, the seawalls experienced significant damage during the 2018 winter storms.
- **Sewer systems/storm drainage** – There is a need to study where sewer systems are at risk, concerning floodwaters or sea level rise coming up through the manhole drains or impacting sewage pump stations. There is a critical sewer pump station in a low-lying

area behind Richdale's. It is also known that water pools at the storm drain by Fin & Feather and Fortune Palace, businesses that are located along Main Street/Causeway in low-lying areas.

- **Power outages:** Winter snow storms and wind events experienced in the early months of 2018 caused widespread power outages across Essex and the region, and drew significant attention to the risks to the power grid from future severe weather events, primarily due to damage from trees and limbs during the storms. Previous Hazard Mitigation planning had identified an old and susceptible power line, feeding between the main line on Western Avenue and the town's water filtration plant on Centennial Grove Road, as a significant issue, causing frequent power outages. Repairs were made in 2017 (see strengths).

**Societal Features:** The CRB Workshop facilitated a robust discussion of the town's demographics and of its societal vulnerabilities to climate impacts. According to information compiled by MAPC using Census 2010 data, the Town of Essex has:

- Total population in 2010 = 3504; total population projected for 2030 = 3664 to 3757
- Population over age 65 in 2010: 490; population over age 65 projected for 2030: 1,119
- 96% of the population is White, 1.3% is Latino, 1% is Asian, and 1.5% is Another Race
- 24% of the population is under age 18
- 22% +/- 7% of occupied housing units are renter-occupied

Discussions centered on these facts:

- **People Living in Coastal Hazard Zones:** 5% of Essex residents (181) currently live in coastal hazard zones. By 2070 this will increase to 9% (331 residents). 18% of these residents living in coastal hazard zones are over age 65. Many homes in Essex are seasonal or renter-occupied.
- **People Working in Coastal Hazard Zones:** 10% (142) of people working in Essex currently work in coastal hazard zones with a low probability of flooding. By 2070 this will increase to 14% (191), nearly all working at businesses in a high probability zone. Of the small businesses (<20 employees) in Essex, 24 are located in hazard zones; this will grow to 33 businesses by 2070.

Participants agreed that there is a significant need for the community to enhance its efforts to educate and communicate about climate-related hazards, particularly to these citizens identified as living or working in coastal hazard zones. Communications needed include information on how to prepare and plan for weather-related hazards, both now and in the future, as well as information provided during an emergency. Some systems that are in place now are helpful and important (e.g. Town Notices, emergency alerts), however there will be an enhanced need for improved communications for both residents and businesses, as well as those beyond the town's borders, including tourists and visitors who are travelling to and through the community.

**Environmental Features:** Many of the town's most vulnerable environmental features have been documented earlier in this report during the discussion of Top Hazards, so will be briefly summarized here.

- **The Great Marsh:** is under threat from sea level rise, erosion, and non-point source pollution
- **Crane Beach:** the southern tip of the barrier beach is rapidly eroding during storm events, causing reduction of its protective services of the Essex infrastructure located behind it and along the Causeway
- **Inland wetlands, streams, lakes:** their ecosystem services are being compromised by stormwater pollution from development, improperly-sized culverts, and expansive beaver activity that increases flooding and impacts infrastructure. Climate impacts including heavier and more frequent precipitation and storms will stress inland streams and wetlands, bringing scouring, erosion, and increased pollution. All aspects of the hydrology of the community, including stream flow and below-ground water supplies, will be affected by longer periods of dry days and overall drought.
- **Forests:** warmer temperatures are increasing outbreaks of forest pests and pathogens.

#### **4. Current Strengths and Assets**

Among the discussion groups at the workshop, there was consensus about the general overall strength of the community, arising from its small size which allows it to be nimble and action-oriented, combined with the committed leadership of elected and appointed officials. Essex has been a leader in the region's efforts towards resilience and protection of natural resources, driving important regional initiatives and setting examples for its neighboring communities. One key example of this leadership involves the town's hosting of the Great Marsh Symposium ([www.greatmarsh.org](http://www.greatmarsh.org)) for the last seven years.

A number of specific strengths were also identified among the infrastructural, societal, and environmental assets of the town. These include:

**Infrastructural:** The town has taken many strides forward over the last 5-10 years to address infrastructural vulnerabilities.

- **Multiple fixed multi-fuel generators** – Identified as a high priority in the 2012 Essex Hazard Mitigation plan, back-up power generators have been purchased and installed at various locations throughout town (Elementary School, Town Hall/Town Library, Senior Center). While the whole town can still lose power (as happened during the recent Storm Riley, March 1-4, 2018, during which 2 million people throughout the northeast lost power), the availability of emergency shelters for warmth and power is a critical strength of the community.
- **Wastewater Treatment** – Main St and Western Ave sewage treatment is provided by Gloucester Sewage Treatment Plant; most of Essex wastewater is cleaned by individual septic systems.
- **Power Lines:** Repairs made in 2017 to the power feeder line between the main line on Western Avenue and the town's water filtration plant on Centennial Grove Road have remedied previous regular outages. The line was completely replaced in 2017 with significant tree removal and clearing as part of the replacement project. This critical facility is now on line with much more regularity, with a generator as back-up.
- **Apple Street** – Having this alternative as a back-up route when the Causeway is closed is an asset, though, as mentioned in other sections of this report, access improvements

are critical. The Apple Street Bridge has recently been inspected and minor repairs have been made.

**Societal:** As mentioned earlier, the Town of Essex has many qualities and systems in place now that are helpful and important to addressing its societal needs. As a small community with a nimble governmental structure, the municipality is well equipped to adapt quickly to emergencies. Town leaders, as well as emergency management officials, are able to communicate with residents through Municipal Notices and an emergency alert system. A strong Council on Aging and Senior Center is able to provide support, programs, and shelter to its most vulnerable senior community members. With the Town Hall and the Town Library sharing a building powered by a back-up generator, there is an accessible, central space for shelter during emergencies. During the most recent winter of 2018 storms and power outages, many town residents, both seniors and others, came to the library for warmth and access to power and the Internet. With a downtown business district that is clustered along the Causeway, information sharing among businesses is facilitated by proximity. Additionally, there is a strong network of regional partners who are prepared and engaged in helping the community of Essex with climate resiliency initiatives.

Specific societal strengths identified by the Workshop participants include:

- **Community Systems for Communication** are available and varied, including: town website, churches, post office as gathering place/communication outlet, Chamber of Commerce, *Cricket* high school newspaper, Youth Commission, web pages (Senior Center, library, town), *Gloucester Daily Times*.
- **Strong Partners**, both local and regional land & water conservation partners, including but not limited to: Essex County Greenbelt Association, The Trustees of Reservations, Manchester-Essex Conservation Trust, Chebacco Lake & Watershed Association, Parker-Ipswich-Essex Rivers (PIE-Rivers) Partnership, Conomo Point Association, Lufkin Point Association, the Great Marsh Coalition, MassBays/Coastal Zone Management, Greenscapes North Shore Coalition, academic/institutional partners including BU, UMass, and UNH.
- **Vibrant Businesses & Overall Economy** which thrive on ecotourism (including marinas, kayaking and other recreational boating, river tours, site-seeing, etc.) and on historical assets such as the Essex Ship-Building Museum and “Antique Alley”

- **“Clam Alley”**: a successful and well-known collection of seafood restaurants along the Essex Causeway, connected to local ecosystems and reliant on seafood, shellfish, etc. The food service industry accounts for 40% of all jobs in Essex.
- **Council on Aging**: Strong and engaged organization to support the elderly population.
- **Schools**: Well-supported and performing Essex Elementary School and Manchester-Essex Regional School District; Parent-Teacher Organization (PTO) funding for enrichment programs; availability as emergency shelters
- **Local Farms**: vibrant local farms and farming families

**Environmental:** As mentioned earlier, the Town of Essex has many natural resource assets that define and sustain its vibrancy. These strengths include:

- **The Great Marsh** – The Great Marsh Area of Critical Environmental Concern (ACEC), originally designated in 1979 as the Parker River/Essex Bay ACEC, includes approximately 20,000 acres of barrier beach, dunes, saltmarsh, mudflats, and water bodies. This coastal ecosystem makes up 22% of the Town’s land area. (MAPC, Town of Essex Hazard Mitigation Plan, 2012). The marsh provides protection to the community from storm surge by absorbing wave energy, and also traps and stores carbon. It also provides habitat for the town’s economically important fish and shellfish economy.
- **Alewife Brook and Chebacco Lake** – The 209-acre Lake and Alewife Brook comprise 3,435 acres of the Essex Bay Area of Critical Environmental Concern, and support the largest breeding population of anadromous Alewife herring on the North Shore. The Chebacco Lake watershed also provides the town’s drinking water supply, with 2/3 of the community’s residents receiving their water from the three gravel-packed wells located near the lake. (The remaining 1/3 of the town has private wells.)
- **The Manchester Essex Woods** – The network of protected conservation land located in the western part of Essex and in its neighboring town, Manchester, comprises more than 3400 acres of forest, wildlife habitat, trails and other recreational assets.
- **Crane Beach** – The southern tip of this protected, natural barrier beach (located in Ipswich) provides protection to Essex Bay and the infrastructure in the community. It is, however, highly vulnerable to climate changes, and is eroding rapidly, thereby reducing this protective service. (See Hazards section above.)

- **Protected Open Space** – Throughout the community, multiple areas are permanently protected as conservation land, including some wetland areas (both coastal and inland) which help absorb storm flooding and may allow for marsh migration as sea level rises.

## **5. Top Recommendations to Improve Resilience**

The participants in the Essex CRB Workshop on April 5<sup>th</sup> determined these Community Actions, below, to be the top priority for the community to take in order to lessen hazard impacts and build resilience. *Actions are listed in order of priority with highest “vote-getters” in red.* Original Top Priority Posters from the workshop sticky dot voting are shown in Appendix F.

### **Environmental Features**

- 1. Salt Marsh Restoration and Management** – Multiple strategies are underway and should be continued and enhanced to restore and protect the Essex salt marsh. These strategies may include: addressing erosion of degraded marsh banks by building mussel reefs and other strategies; studying the movement of sand and sediment throughout the marsh; land protection for marsh migration; exploring opportunities to beneficially reuse dredged material; study and exploration of the development of oyster beds; invasive species removal; planting eel grass to help with wave attenuation during storms; using green infrastructure to reduce stormwater pollution so as to keep shellfish beds open and healthy; and more.
- 2. Mouth of the Essex River Study and Management** – Efforts should continue to work with partners to study and better understand the movement of sediment at the mouth of the Essex River and throughout Essex Bay, including analyses of channel and creek hydrology, marsh platform elevation changes and response to sea level rise, marsh bank stability, and the erosion of the protective tip of Crane Beach (which has begun to allow tidal and storm energy to adversely affect the Conomo Point Seawall system).
- 3. Management of Inland Flooding** – Currently an individual Essex resident works to actively manage the beaver population’s impact on inland flooding. The town should plan for municipal assumption of these management strategies. These stewardship activities (trapping, regulations, etc.) should progress in coordination with municipal efforts to address inland flooding related to culverts and other barriers to flow.
- 4. Chebacco Lake Watershed Protection** – The municipality should work with partners to prioritize the protection of the Chebacco Lake ecosystem, including preservation of wildlife habitat and protection of water supplies. Strategies may include water quality

monitoring, management of invasive species, land protection of the watershed, identification of opportunities and implementation of green infrastructure, education of property owners about stormwater pollution, etc.

5. **Forest Protection and Management** – Town committees and staff should work with local and regional non-profit partners to better understand the impacts of climate change on the forested areas of the town, including both public and private lands, and to develop strategies for ecosystem protection. Resiliency and management actions should address the threats of forest disease, loss of biodiversity, forest fire, invasive species, etc.
6. **Regulatory Issues** – The Town should work with the state and local and regional partners to review regulations and policies that may impede or slow ecological protection and restoration of marshes, beaches and dunes.

### **Infrastructural Features**

1. **Apple Street** – planning and management so as to keep it a safe and useable alternate transportation route when Causeway/Route 133 floods. This action involves making the road more reliably and safely navigable by addressing concerns related to the scenic road regulations, tree-trimming and management, culvert assessment and improvements, signage, and more. Long-term, may need to also consider Rocky Hill Road as another alternate route.
2. **Causeway/Route 133** – overall resiliency planning for the road and for the downtown business district overall. This item includes specific immediate repairs to the Main Street Bridge, working closely with the State who owns the road. Working with the Cape Ann Chamber of Commerce and with a downtown business working group, the Town should maintain and develop its focus on education, communications, emergency planning, and best practices. Long term planning should include considerations of raising the road and also relocating businesses to higher ground (options for retreat). Improved emergency communications measures could include: notifying trucks and all traffic of closure and detour routes before they get to the Causeway itself; better overall traffic measures; moving boats, trash, and business/personal items so they do not float away during storms (boats at the marina were raised up by tide from docked trailers

during recent storms); adding lights that flash certain colors when different storm prevention actions are in effect, and others to be developed.

3. **Safe Drinking Water and Sewer** – study of vulnerabilities related to assuring safe and plentiful drinking water in the future, preparing for the realities of both drought and flooding. Better understanding the risks of salt water intrusion to wells as sea levels rise. There is a critical sewer pump station right behind Richdale's/gas station on Main Street. Work with neighboring towns Ipswich and Gloucester to assure water and sewer line replacement and upgrades as warranted.
4. **Multi-faceted Emergency Warning Systems and Supplies** – development of a comprehensive system of communications and provisions/services for the public in times of emergency. See item in Societal category (below) for more detail.
5. **Standard Monitoring Protocols** – Best practices and a standard monitoring protocol should be developed and implemented to track flooding throughout the community, particularly in the most vulnerable locations, in adherence to a consistent and regular process.
6. **Culvert and Other Structural Improvements:** Use results of the *2018 Great Marsh Barriers Report* to upgrade or replace vulnerable culverts throughout the Town; use updated sea level rise modeling to monitor erosion and scouring and to ensure stability of roads; regularly remove debris caught in culverts. Study which portions of the Conomo Point infrastructure are most vulnerable given the new patterns of tidal and storm energy, and where and how to reinforce, repair, and plan for resiliency.

## Societal Features

1. **Climate Resiliency Municipal Outreach & Education Program** – Develop and implement a program using a “top down” approach led by the Town’s Strategic Planning Committee and other municipal committees and boards. Focus on “helping people prepare”, including education, awareness, and implementation of individual and community strategies (from elevating propane tanks from vulnerable areas to signing up for emergency alert notices, from requiring renters insurance to using social media, and more.) Work with partner organizations such as the Chamber of Commerce,

the town library, churches, Council on Aging, and others. Develop unified messages targeted for specific audiences.

2. **Emergency Services** - An extension of #1 focused on specific strategies and plans for emergencies, including sheltering plans, provisions of supplies, enhanced communications, and disaster relief. Communications and collaborations with neighboring municipalities and regional organizations.
3. **Adoption of the Great Marsh Coastal Adaptation Plan** – Formally adopt the *December 2017 Great Marsh Plan* and develop a process and structure for implementation.
4. **Community Database** - Create and maintain a database of vulnerable citizens, working with the Council on Aging and Emergency Services, including citizens living in high risk areas as well as citizens with specific characteristics or disabilities (for example, hearing impairments, reliance on refrigerated medications, seniors living alone, citizens who don't drive therefore can't evacuate, etc.)
5. **Business Working Group** – Develop and implement an effort whereby the Town works with the Chamber of Commerce, Merchants Groups, and individual businesses on climate resiliency planning, education and knowledge sharing, best practices, sharing emergency resources, etc.

## 6. Conclusion and Next Steps

The Town of Essex presented the recommendations of the CRB Workshop at a public forum held on April 25, 2018, in Essex Town Hall. This session was held in conjunction with the *Coastal Emergency Planning & Resilience Public Forum* hosted by the Cape Ann Emergency Planning Team in partnership with the Massachusetts Office of Coastal Zone Management (CZM) and the National Wildlife Federation. Publicly posted and advertised, residents of Essex and Cape Ann communities were invited to attend the meeting to learn more about coastal resilience and how it relates to emergency preparedness. The forum provided an opportunity for the public to learn, ask questions, and provide feedback about the April 5<sup>th</sup> CRB Workshop and the recommended highest priority actions that emerged from that workshop.

Priorities identified during the April 5, 2018 CRB Workshop will be integrated into existing and near future municipal planning efforts. In May, 2018, the Town applied for funding through the MVP Action Grants. On June 1, 2018, they were granted funds to study two of the salt marsh restoration projects identified in the workshop: 1) study of the natural sediment deposition event from January, 2018, as an option for future sea level rise mitigation (working with UNH and BU), and 2) site analysis and feasibility work on a mussel reef project (working with Northeastern and DeRosa Environmental).

The Town of Essex will continue to improve the Town's resilience to climate change by implementing other top priority strategies in the months and years to come.

**Town of Essex, MA**  
**Community Resilience Building Workshop**  
**Summary of Findings**  
**June 2018**

## **Appendices**

Appendix A: Workshop Agenda .....	A2
Appendix B: Workshop Invitation .....	A3
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# Municipal Vulnerability Preparedness Workshop

## Town of Essex, MA

Thursday, April 5, 2018, 8:00am–2:30pm

Essex Town Hall

### AGENDA

The Massachusetts **Municipal Vulnerability Preparedness Program** provides support for cities and towns in Massachusetts to plan for climate resiliency and prepare immediate action steps.

TIME	ACTIVITIES	WHO
8:00 AM	Registration and Refreshments	
8:30 AM	Welcome	Brendhan Zubricki
8:40 AM (10 mins)	Introductions & Overview of the Workshop	Kristen Grubbs
8:50 AM (45 mins)	Overview Presentation on Science, Past Planning Efforts and Outcomes, and Data Resources Q & A / Large Group Discussion	K. Grubbs & Facilitators Sam Cleaves, Liz Duff, & Peter Phippen
9:35 AM (10 mins)	Instructions & Break into Small Groups	
9:45 AM (50 min total: 5 min intros; 15 min/feature)	Small Group Exercise #1 Review Vulnerabilities and Strengths for Infrastructure, Societal, and Environmental Features	Small groups & facilitators
10:35 AM	10 MINUTE STRETCH	
10:45 AM (75 min total: 25 min/feature)	Small Group Exercise #2 Identify Community Actions to address vulnerabilities or protect strengths of Infrastructure, Societal, and Environmental Features Determine Top 3 Priority Actions for Each Feature	Small groups & facilitators
12:00 AM (45 mins)	LUNCH	
12:45 PM (30 mins)	Large Group Reconvenes Small Group Spokesperson Reports Top Priority Actions	K. Grubbs & spokespersons
1:15 PM (45 mins)	Large Group Activity & Discussion Determine Overall Priority Actions (sticky dot activity) Top 3 Actions for Municipal Climate Resilience	K. Grubbs & facilitators
2:00 PM (15 mins)	Closing Remarks & Next Steps How will Essex use the recommendations/outcomes from the MVP/Hazard Mitigation workshop?	B. Zubricki
2:15 PM	Adjourn	

For more information about the Essex MVP Workshop, please contact Kristen Grubbs, Environmental Planner, Ipswich River Watershed Association ([kgrubbs@ipswichriver.org](mailto:kgrubbs@ipswichriver.org), 978-412-8200)





# Municipal Vulnerability Preparedness Program

## Town of Essex, MA

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In September 2016, Massachusetts Governor Charlie Baker signed Executive Order 569, instructing state government to provide assistance to cities and towns to complete climate change vulnerability assessments and resiliency action plans. The Municipal Vulnerability Preparedness (MVP) program provides funding for communities in Massachusetts to begin this process. The program helps communities to:

- ✓ Define extreme weather and natural and climate related hazards
- ✓ Identify existing and future vulnerabilities and strengths
- ✓ Develop and prioritize actions for the community
- ✓ Identify opportunities to take action to reduce risk and build resilience

**The Municipal Vulnerability Preparedness Program** provides support for cities and towns in Massachusetts to plan for climate resiliency and prepare immediate action steps.

MVP certified providers, trained in workshops across the state, will provide technical assistance to communities in completing the assessment and resiliency plan using the Community Resilience Building Framework, a process developed by the Nature Conservancy that the State of MA has chosen to use for the MVP program: <https://www.communityresiliencebuilding.com/>. Communities who complete the MVP program become certified as an MVP community and are eligible for follow-up grant funding and other opportunities. For more information: <https://www.mass.gov/municipal-vulnerability-preparedness-program>

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The Town of Essex was one of the [first 71 communities](#) across the Commonwealth to receive MVP funding, and has now contracted with the [Ipswich River Watershed Association](#) (IRWA) to provide the technical management of the MVP grant. Working with the Essex Town Administrator Brendhan Zubricki, IRWA planner Kristen Grubbs has begun gathering information regarding potential climate hazards and risks, both public health concerns and coastal impacts. The next step is convening a group of stakeholders in Essex to review, comment on, and prioritize how the Town will deal with these factors in the future.

***You are invited to join us! Our goal is to work together to determine and prioritize mutually beneficial actions that address the vulnerabilities of our community.***

***Please save the date of Thursday, April 5, 2018.***

**Who:** Diverse group of stakeholders in the Town of Essex, including you

**What:** Municipal Vulnerability Preparedness Workshop

**When:** Thursday, April 5, 2018, 8-2:30 (including coffee and lunch)

**Where:** Essex Town Hall

**RSVP to:** Pam Witham, [pwitham@essexma.org](mailto:pwitham@essexma.org) or 978-768-6531

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For more information about the MVP process, please contact **Kristen Grubbs** ([kgrubbs@ipswichriver.org](mailto:kgrubbs@ipswichriver.org), 978-412-8200)

ESSEX COMMUNITY RESILIENCY BUILDING WORKSHOP - MVP PROGRAM			
April 5, 2018			
Stakeholder Group	Representative (invited)	RSVP	Attended
Businesses	Scott DeWitt, Perkins Marina	NO	no
Businesses	Scott Woodward, Pike Marina	NO	no
Businesses	Curt Bergeron, Essex Marina	YES	no
Businesses	Bob Coviello (or designee), Essex Merchants' Group	NO	no
Businesses	Ken Riehl (or designee), Cape Ann Chamber of Commerce	YES	x
Businesses	Eian Woodman	YES	x
Community leaders/champions	Sue Lufkin	NO	no
Cultural resources	Chair, Essex Cultural Commission, Rob Fitzgibbon	YES	x
Developers	David Cutter	NO	no
Elderly	Council on Aging Director, Kristen Crockett	YES	x
Elderly	Council on Aging, Michele French, Chair	YES	x
Housing	Essex Housing Authority Director or Board member	no reply	no
Library/historians	Deb French, Librarian	YES	x
Library/historians	Kurt Wilhelm, Local Historical Expert	NO	no
Library/historians	Nat Crosby, Essex Historical Commission	YES	x
Library/historians	Gail Kubik, Cons Comm, Salem State Disaster Coordinator	YES	x
Neighborhood groups/residents	Laura Collins, President, Conomo Point Assoc.	NO	no
Neighborhood groups/residents	Dan Mayer	YES	x
Non-profits	Chebacco Lake & Watershed Association, Keith Symmes	YES	no
Non-Profits	Michelle Vaillancourt, Manchester Essex Conservation Trust	YES	x
Non-profits	Ed Becker (or designee), Greenbelt	NO	no
Non-profits	Liz Duff (or designee), MA Audubon	YES	x
Non-profits	Katie Andrews, MA Audubon Intern	YES	x
Non-profits	Kristen Grubbs, IRWA	YES	x
Non-profits	Russell Hopping, The Trustees	YES	x
Non-profits	Peter Pinciario, The Trustees (requested to attend)		x
Non-profits	Jeff Denoncour, The Trustees (requested to attend)		x
Non-profits	Tom O'Shea, The Trustees (requested to attend)		x
Non-profits	Rachel Schneider, IRWA	YES	x
Non-profits	Kristen Thiebault, IRWA	YES	x
Recreation/parks/athletic groups	Chair, Manchester Essex Little League	no reply	no
Religious institutions	Tim Ziegenhals, 1st Congregational Church of Essex	YES	x
Religious institutions	Justine Sullivan, First Universalist Church of Essex	NO	no
Religious institutions	Priest, St. John the Baptist Catholic Church	no reply	no
Regional Planning Agency	Peter Phippen, MVPC/8 Towns & Great Marsh (also a resident)	YES	x
Regional Planning Agency	Sam Cleaves (or other MAPC representative)	YES	x
Schools	Manchester Essex Regional School District, Annie Cameron	YES	x
Schools	Katie Kahl, Sustainable Fisheries & Coastal Resilience, UMass, Amherst	YES	x
Schools	Theresa Whitman, PTO President, Essex Elementary School	YES	x

List continued on next page.

ESSEX COMMUNITY RESILIENCY BUILDING WORKSHOP - MVP PROGRAM				
April 5, 2018				
(continued)				
Stakeholder Group	Representative (invited)		RSVP	Attended
Town Committee	Julie Scofield, Open Space Committee Chair	j	NO	no
Town Committee	Robin Kanter	t	YES	x
Town Committee	Nancy Dudley	d	YES	no
Town Committee	Lisa O'Donnell, Selectman	l	YES	x
Town Committee	David Doane, Selectman	d	no reply	no
Town Committee	Andrew Spinney, Selectman	a	NO	no
Town Committee	Carol McMahon, Cape Ann Emergency Planning Team	c	no reply	no
Town Govt	Animal Control Officer, Amy Reilly	a	NO	no
Town Govt	Board of Appeals Chair, Meg Nelson	r	NO	no
Town Govt	Board of Health Administrator, Erin Kirchner	e	YES	x
Town Govt	Board of Health Chair, Dr. David Driscoll	d	NO	no
Town Govt	Board of Public Works Superintendent, Paul Goodwin	p	YES	x
Town Govt	Board of Public Works Chair, Brian Feener	r	no reply	no
Town Govt	Conservation Agent, Ken Whittaker	k	NO	no
Town Govt	Conservation Commission Chair, Michael Burke	r	YES	x
Town Govt	Finance Committee Chair, Michelle Dyer (or designee)	r	NO	no
Town Govt	Fire Chief, Dan Doucette, (a deputy as backup)	d	YES	x
Town Govt	Planning Board Chair, Westley Burnham	v	YES	x
Town Govt	Police Chief, Peter Silva, (Sergeant Paul Francis, as backup)	r	YES	x
Town Govt	Shellfish Constable, Billie Knovack	v	YES	x
Town Govt	Town Administrator, Brendhan Zubricki	b	YES	x
Town Govt	Town Planner, Matt Coogan	r	NO	no
State Govt	Kathryn Glenn, CZM		YES	x
			<b>TOTAL:</b>	36



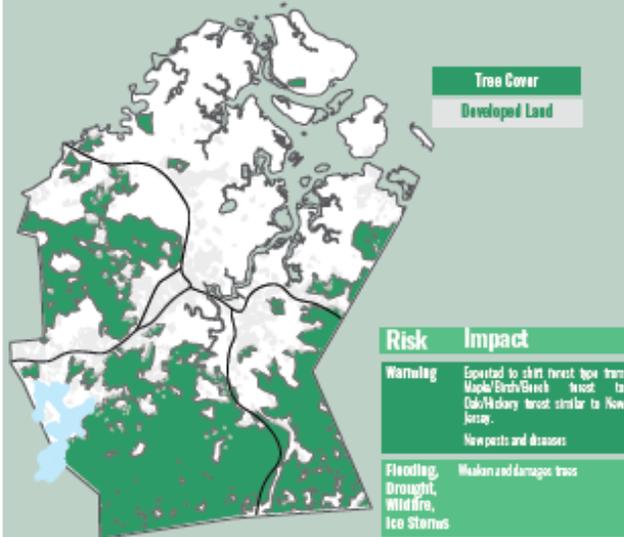
# Essex

## Natural Resources

Natural Resources lessen climate impacts by absorbing and storing carbon dioxide and by serving vital protective functions. Forests, open space, wetlands, rivers, and streams protect drinking water quality and quantity, provide flood control, and give relief from extreme heat. Healthy ecosystems are more resistant to stresses from a changing climate and better able to protect against heat and flooding.

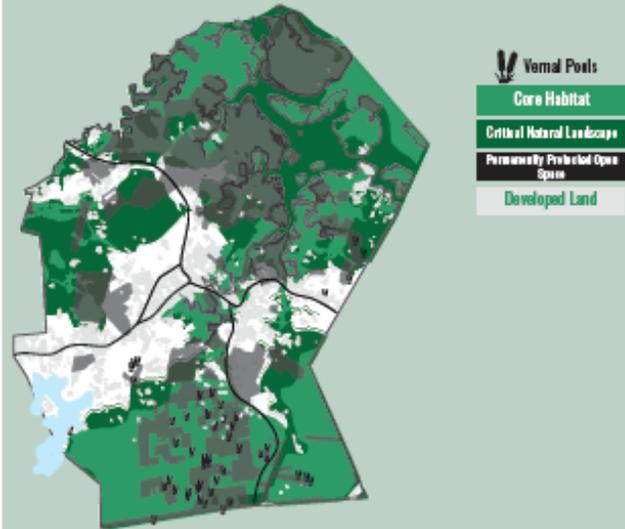
### Trees

Trees are important in mitigating the impact of heat waves. According to the EPA, suburban areas with mature trees are 4-6 degrees cooler than new suburbs without trees. Shaded surfaces can be 25-40 degrees cooler than the peak temperatures of unshaded surfaces. Trees also absorb remarkable quantities of precipitation. Research has shown that a typical healthy-sized tree can intercept as much as 2,390 gallons of rain per year (USDA Forest Service).



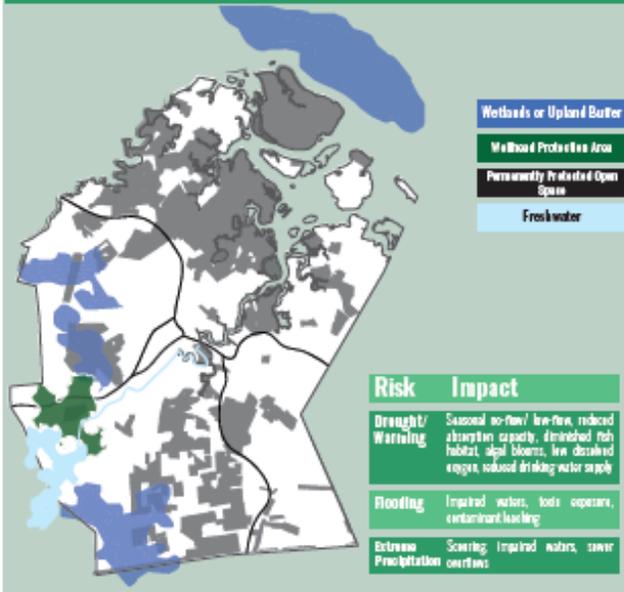
### Terrestrial Resources

The areas of Core Habitat and Critical Natural Landscape in Essex demonstrate a contiguous track of exemplary ecosystems that weave a fabric of resilience. These areas can endure climate change stressors to continue to provide important ecosystem services such as flood control, clean water, clean air, species diversity, and cooling temperatures. They also sequester and store carbon dioxide. Vernal pools, or small seasonal wetlands, are crucial habitats for species such as salamanders.



### Freshwater Resources

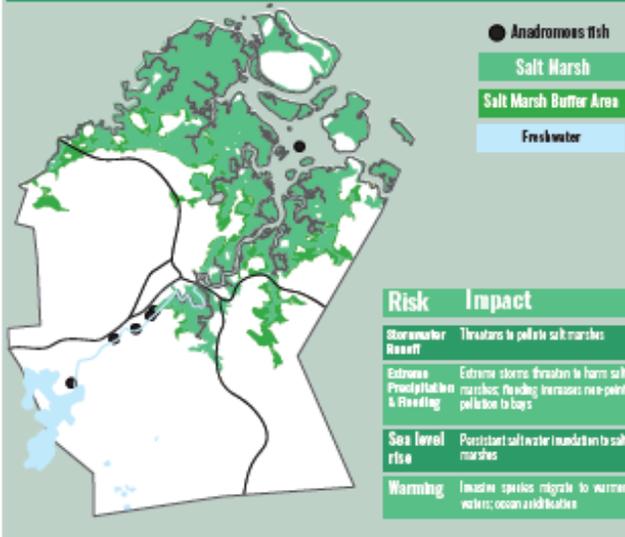
Essex contains healthy, intact freshwater wetland systems that sustain critical ecosystem functions in climate change. These ecological assets protect drinking water quality and quantity, provide flood control, and maintain overall ecosystem health for climate resilience.



### Coastal Resources

Salt marshes and estuaries are complex and highly productive ecosystems generally resilient to wide variations in temperature, salinity, and inundation. Ecological benefits of salt marshes include: floodwater storage, storm surge protection, carbon sequestration/storage, nutrient removal, water quality improvements, and commercial fish and shellfish habitat.

Coastal bays host critical ecosystems for coastal resilience: shellfish growing areas, eel grass meadows, anadromous fish (saltwater fish that spawn in fresh water), and resident and migratory birds, some of which are threatened and endangered.



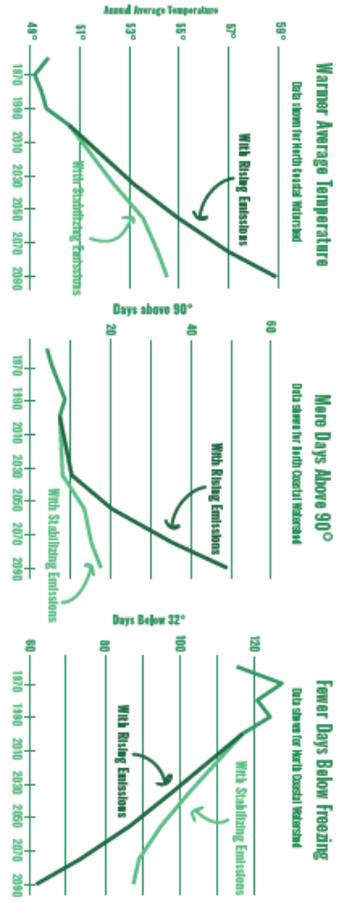
Sources: MassGIS (Bureau of Geographic Information); BioMap2: Conserving the Biodiversity of Massachusetts in a Changing World; Massachusetts Department of Fish and Game; Massachusetts Department of Environmental Protection; MassGIS (Bureau of Geographic Information); National Land Cover Database (NLCD); Trust for Public Land; MAPC; University of Vermont

# Climate Change

Essex and the North Coastal Watershed

Our climate is regulated by "greenhouse gases (GHGs)" that trap heat, including carbon dioxide, methane, and nitrous oxide. In the past century, the combustion of fossil fuels, our primary energy source in the age of industrialization, has increased the concentration of GHGs in the atmosphere, which has caused global temperatures to rise. If people stabilize GHG emissions, global temperatures may rise more slowly. If emissions continue increasing at the same rate, we can expect more extreme changes in the climate.

## Higher Temperatures



## As the climate changes, Essex can expect...

### More Large Storm Events

In addition to increasing annual precipitation, climate change will bring more large storm events. This will lead to more stormwater flooding, as most stormwater drainage has been sized to 1961 standards. 10-year, 24-hour storms refer to the 24-hour rainfall total for the biggest storm expected in a 10-year period.



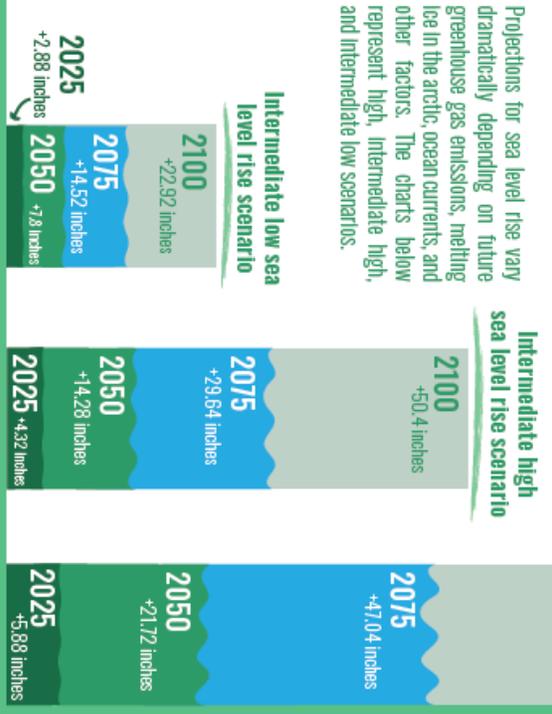
### More Annual Precipitation

But less in the summer and fall... While total annual rainfall and large rainfall events are projected to increase, summer and fall rain is projected to decrease slightly.

And more frequent droughts... Due to the combined effects of earlier snowmelt, less rain, and higher temperatures, summer and fall droughts may become more frequent.

### Rising Seas

Projections for sea level rise vary dramatically depending on future greenhouse gas emissions, melting ice in the arctic, ocean currents, and other factors. The charts below represent high, intermediate high, and intermediate low scenarios.



Sources: Biological: Conserving the Biodiversity of Massachusetts in a Changing World; Massachusetts Department of Fish and Game; Massachusetts Department of Environmental Protection; Massachusetts Bureau of Geographic Information; National Land Cover Database (NLCD)

# ESSEX

## Social Vulnerability

Social vulnerability refers to social, economic, demographic, or health factors that may make groups of people less resilient to climate change impacts. Certain vulnerabilities tend to be correlated. For example, older adults are more likely to have a disability and live alone than younger adults.

Our strategies for adapting to a changing climate should protect these populations in addition to our natural and built environment.

## Who is most at risk from climate change impacts?

**People who may be more susceptible to negative health effects:** These can include older adults, young children, pregnant women, people with disabilities, and people with pre-existing health conditions, as they are more likely to be physically vulnerable to the health impacts of extreme heat and poor air quality caused by climate change. Individuals with physical mobility constraints, such as people with disabilities and seniors, may need additional assistance with emergency response.

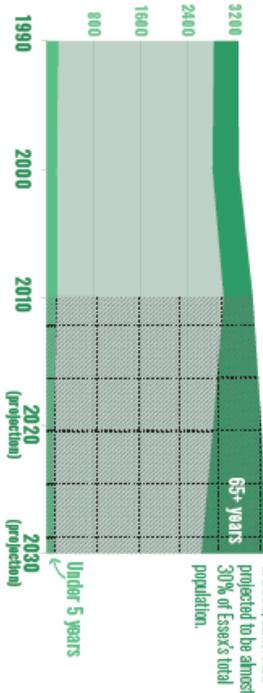
**People who may have more difficulty adapting to, preparing for, or recovering from extreme weather events:** Socioeconomic characteristics such as income and race can influence vulnerability to climate change. Low-income people are often more susceptible to financial shocks, which can occur after extreme weather and which can impact financial security and the ability to secure safe shelter and meet medical needs. Social isolation can also influence vulnerability, as it limits access to critical information, municipal resources, and social support systems. People at the most risk for social isolation include those living alone and people with limited English language proficiency.

**People who live or work in vulnerable locations:** Historic or predicted floodplain, urban flooding locations, areas prone to wildfire, heat islands, neighborhoods prone to power outages, outdoor workers, first responders, those working in hot indoor environments.

### Older Adults and Young Children

Adults over 65 and children under 5 are more likely to develop health problems on very hot days or during heat waves. Older adults are also more likely to have disabilities or mobility constraints and may need additional assistance during emergencies. They are also more likely to live alone than younger adults.

#### Essex Recent and Projected Population by Age



In 2030, seniors are projected to be almost 30% of Essex's total population.

### People Who Work Outside

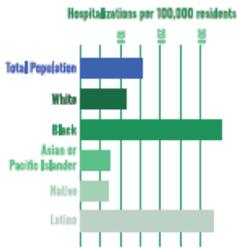


People who primarily work outside, such as parcel delivery people, construction workers, or farmers, may be at added risk from extra exposure to high heat and poor air quality.

### People with Health Conditions

People who are already in poor health are more likely to be harmed by hot weather and resulting poor air quality.

#### Massachusetts Asthma Hospitalizations



### People Living Alone



As of 2010, approximately 30% of Essex households consisted of someone living alone.

About one-third of people living alone were over 65.

### Communities of Color

Particular racial or ethnic groups may also be more likely to have certain social vulnerabilities than others. For example, Black and Latino populations have a much higher rate of asthma hospitalizations than other groups.

**Essex is becoming more diverse...**

Although over 95% of the town's population is white...

Populations of color have increased since 1990.

**11x**

African American population increase since 1990

**3x**

Asian population increase since 1990

**2.5x**

Latino population increase since 1990

### Low Income Households

Households that earn low incomes are more susceptible to financial shocks, triggered by extreme weather, which can cause long-lasting financial insecurity and can make it hard to secure safe shelter, sufficient food, and medical care.

**29.6% ± 8%**

A four-person household earning less than \$54,200 is considered low-income



Sources: American Community Survey (ACS) 2012-2016; United States Census 1990, 2000, 2010; MAPC Projectors; Massachusetts Department of Public Health Asthma Data, 2008-2012

**Box 4.1-1. Regional Adaptation Strategies & Recommendations for the Great Marsh Region**

**Best Practices** *(see also page 126-130)*

- Establish and maintain a permanent Municipal Resiliency Task Force or committee
- Set clear goals for addressing existing and projected vulnerability
- Collaborate across municipal departments
- Collaborate across municipal boundaries
- Protect and enhance biodiversity
- Reduce non-climate stressors
- Evaluate effectiveness of adaptation strategies at regular intervals
- Monitor coastal hazards and maintain strong research initiatives
- Promote economic diversity
- Incorporate climate change adaptation planning and climate projections into all relevant local and regional plans as well as capital investment projects

**Natural and Nature-Based Strategies** *(see also page 130-137)*

- Ensure and restore connectivity of river and coastal systems
- Use living shorelines to stabilize shoreline edges, where appropriate
- Explore construction of offshore shellfish reefs and beds to attenuate wave energy, reduce erosion, and improve water quality
- Protect and restore barrier beaches and dunes through renourishment and revegetation
- Explore opportunities to beneficially reuse dredged material
- Restore sub-aquatic vegetation
- Restore degraded salt marshes
- Facilitate marsh migration
- Enhance land conservation efforts

**Gray Infrastructure and Retrofits** *(see also page 138-139)*

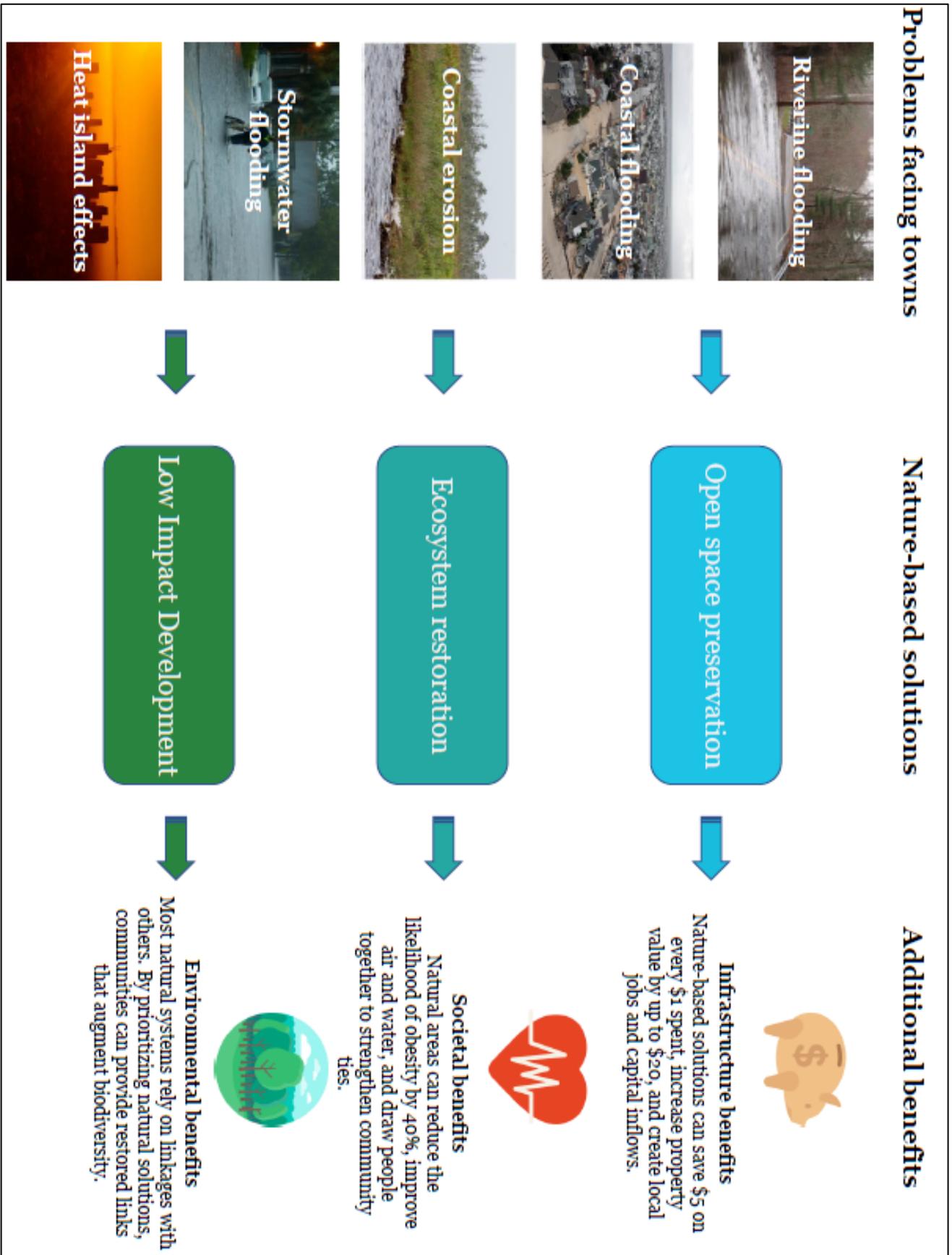
- Remove unnecessary dams
- Upgrade road-stream crossings
- Retrofit buildings to be more flood resilient
- Elevate roadways to prevent nuisance flooding and to withstand projected sea level rise
- Pursue retrofits and planning for Massachusetts Bay Transportation Authority (MBTA) railroad

**Land-use Planning and Policy** *(see also page 140-144)*

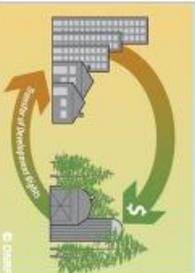
- Update municipal policies
- Prioritize low-impact development (LID) practices
- Revise local wetlands protection bylaws and regulations
- Move development away from the coast and from wetlands
- Create “freeboard incentive” for residential and commercial buildings
- Use transferable development credits (TDCs) to reduce risky coastal development
- Institute comprehensive water resources management, including strategies for stormwater, waste water, and public drinking water

**Outreach and Engagement** *(see also page 144-146)*

- Develop municipal strategies for enhanced outreach and education
- Strengthen existing regional outreach and education programs
- Support and develop opportunities for citizen science



# Appendix D: NWF Guide to Nature-Based Climate Adaptation Strategies

Sample Guide to Climate Adaptation Strategies			What are Your Project Goals?		
Natural Solutions			Nature-Based & Hybrid Strategies		
<p><b>Remove Invasives</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Supports marsh ecosystem health &amp; function. A healthy marsh provides storm protection, erosion control, and supports wildlife habitat.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>May not be ecologically appropriate</li> <li>Requires maintenance</li> </ul>	<p><b>Vegetated Shoreline</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Provides shoreline stability, reduces erosion, and buffers upland areas from small waves.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Limited flood protection depending on site features</li> <li>Plant growth not guaranteed</li> </ul>	<p><b>Land Acquisition</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Strategic protection of land adjacent to salt marshes can help facilitate marsh migration and reduce damage from flooding.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Can be expensive</li> <li>Not always politically expedient</li> </ul>	<p><b>Shellfish Reef</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Offshore living structures that enhance water quality, reduce erosion, and act as a submerged breakwater to reduce wave energy.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Overtopped by major storms</li> <li>Easily damaged by debris and ice</li> </ul>	<p><b>Edging/sills</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Natural vegetation combined with engineered structures parallel to coastline, reduces erosion and wave energy, and enhances wildlife habitat</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Limited storm surge reduction</li> <li>Requires more land area to implement</li> </ul>	<p><b>Thin-layer Deposition</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Raises the marsh platform by spraying sediment onto the marsh surface, mostly applied in sediment starved environments</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Impacts not fully understood</li> <li>Unknown utility in marshes that aren't highly degraded</li> </ul>
Gray Infrastructure			Policy Strategies		
<p><b>Revetment</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Rocks or other material placed on a sloping shoreline to stabilize the shore and to mitigate wave energy.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>No major flood protection</li> <li>Prevents upland sediment transport to estuarine habitats</li> </ul>	<p><b>Bulkhead</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Vertical wall suitable in high-energy settings; stabilizes shoreline and reduces flooding.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Can erode adjacent areas</li> <li>Prevents upland sediment transport to estuarine habitats</li> </ul>	<p><b>Road Flood Barriers</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Various designs exist, but all are meant to prevent flood waters from entering the roadway.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Short-term/temporary solution</li> <li>Limited/no co-benefits</li> </ul>	<p><b>Zoning</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Utilizes zoning overlays to limit development in flood-prone areas (legal precedent exists in MA).</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Can impact property tax base</li> <li>May lead to legal challenges</li> </ul>	<p><b>Climate-smart Development</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Requires SLR to be considered in development proposals. Promotes open spaces to increase flood resiliency.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Creates additional work for developers up front</li> <li>Doesn't require action</li> </ul>	<p><b>Transferable Development Credits</b></p>  <p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>Market-based approach (with existing MA guidelines) that incentivizes development away from flood prone areas.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>Can be costly and complex to implement</li> <li>Requires calibrated market</li> </ul>

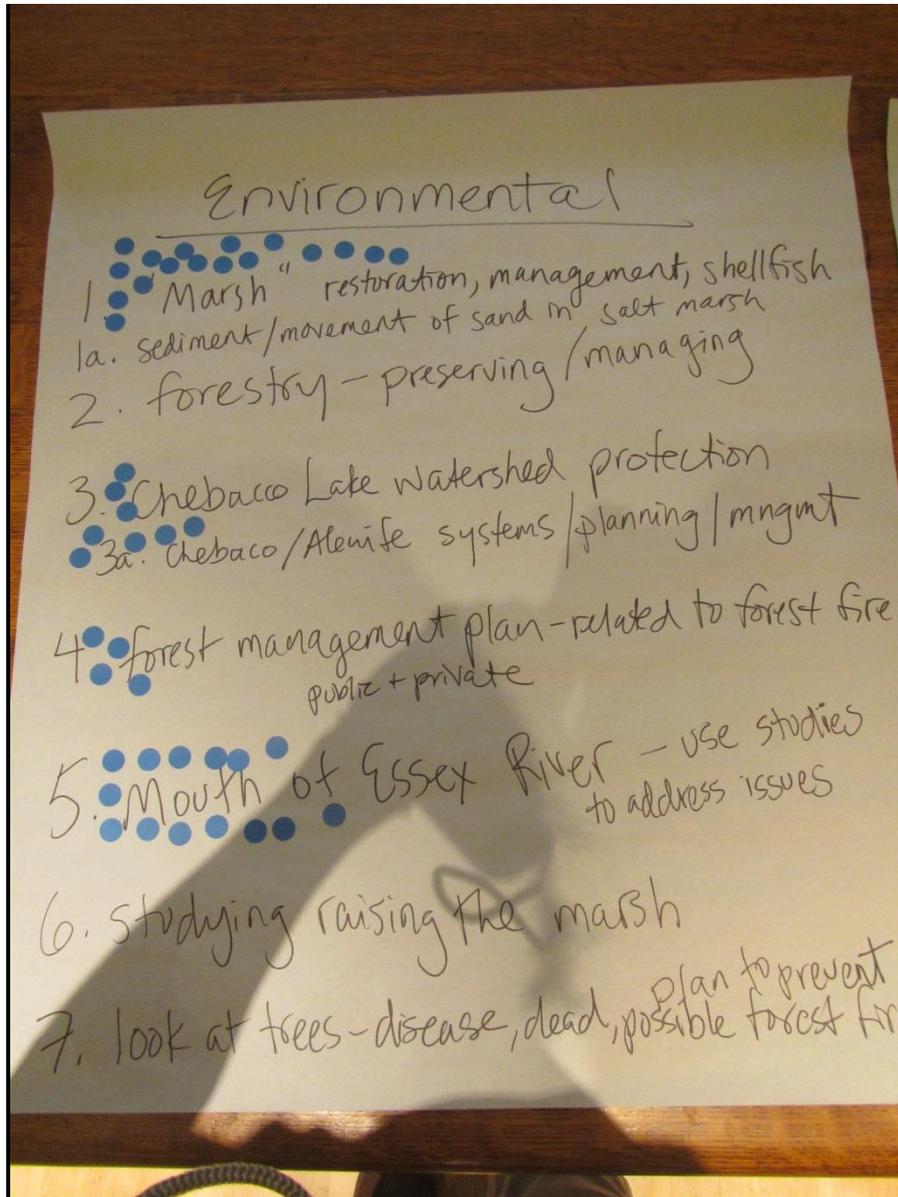


## Sample Guide to Climate Adaptation Strategies

## What are Your Project Goals?

- Flood Protection
- Wave Attenuation
- Water Quality
- Erosion Control
- Habitat Restoration
- Scenic/Recreational Value

## Appendix E: Top Priority Posters with Sticky Dot Votes



## Environmental

8. Beavers - plan for future management (esp. near Chebacco)

## Infrastructure

1. Causeway / Rt 133 working w/ the State
2. Apple Street - steep + floods trees / scenic byway what can we do? to keep it safe + useable utilities safe
3. drinking water
4. Causeway Business Group / resiliency planning
5. water system - study of vulnerabilities

# Infrastr

6. Multi-faceted <sup>emergency</sup> warning system  
(public) cameras, lights, monitoring live feed

7. Main St. Bridge - need to repair  
(State plans to work on 2021 - not soon enough)

by way  
eable

# SOCIETAL

① Adoption of Great Marsh Plan

② Long-term resiliency planning

③ Outreach + education program  
municipal/committees - Strategic Committee  
Outreach + education

④ database of vulnerable populations  
throughout town

⑤ emergency services sheltering pla  
supplies/communication

6. Outreach to all

7. "Prepa

8. B

ish Plan

anning

gram  
strategic  
Committe

tions:

on

pla

ron

# Societal

6. <sup>③</sup> Outreach <sup>esp.</sup> to seniors, students, families  
to all

7. "Preparedness Training" education + specific actions  
①

8. Business Community - educate Best Practices  
+ Chamber Share Knowledge  
⑤

## Essex Community Resiliency Building Workshop: April 5, 2018: Summary of Findings

### Top Hazards

1. Coastal Storm Surge & Sea Level Rise
2. Inland Flooding
3. Extreme cold/winter storms/snow
4. Heat/fire/drought

### Highest Priority Actions *(Top 4 in red, 3 in parenthesis indicates total sticky dot votes)*

#### Environmental Features

1. **Salt Marsh Restoration and Management** – including protection of shellfish, addressing erosion, study of sediment and movement of sand throughout the marsh)
2. **Mouth of the Essex River** – study of sediment and movement of sand
3. **Management of Inland Flooding** – plan for municipal stewardship, beaver management
4. **Chebacco Lake Watershed** – protection of ecosystem, wildlife habitat, and water supply
5. **Forest Protection & Management**, both public & private lands, to address disease and forest fire
6. **Regulatory Issues** – working with partners

#### Infrastructural Features

1. **Apple Street** – planning and management so as to keep it a safe and useable alternate transportation route when Causeway/Route 133 floods
2. **Causeway/Route 133 Resiliency Planning**, including Main St. bridge repairs – working with the State and with business groups
3. **Safe Drinking Water & Sewer** – study of vulnerabilities; safe/plentiful drinking water
4. **Multi-faceted Emergency Warning System** for the public
5. **Standard Monitoring Protocols** – best practices for monitoring flooding and erosion impacts
6. **Culvert and Other Structural Improvements**: upgrade or replace vulnerable culverts; further study of infrastructure most vulnerable to tides/ storm energy, esp. Conomo Pt.

#### Societal Features

1. **Municipal Outreach & Education Program**, including Preparedness Training
2. **Emergency Services & Sheltering Plan, supplies & communications plan**
3. **Adoption of Great Marsh Coastal Adaptation Plan**
4. **Create Database of Vulnerable Citizens**
5. **Business Working Group** – Community, business groups, & Chamber of Commerce, education and knowledge sharing, including best practices & emergency resource sharing

## Appendix G: Workshop Evaluation Excerpts

Participants were asked:

**What was your favorite part of today's workshop?**

Answers included these excerpts:

- *Getting a sense of what a cross-section of people who are influential within Essex think regarding MVP. Interesting to see the perspectives and the attitudes.*
- *Having the diversity of decision-makers hear the same information; discussing viable options with multiple perspectives; making people prioritize*
- *The fact that we had a goal and were deciding some priorities that would/could actually be used to 1) apply for funding and 2) to guide town policy and future decisions*
- *The diversity of participants. Each person had a different perspective that was extremely valuable. This workshop brought in people who wouldn't be included typically.*
- *Getting to know other concerned citizens in town.*
- *Different opinions of the issues and variety of possible solutions*
- *Networking and sharing concerns/ideas*
- *Working together for our town and community. Knowledge that was only superficial now comes to the forefront.*
- *Great fun! Loved hanging out with town movers & shakers.*
- *Very interesting day. Learned a lot. Great energy in the groups.*
- *Talking to neighbors and experts about the issue and possible ways to fix it.*

Thank you to all workshop attendees for their time and participation. Your input during the discussions and at any time hereafter is very valuable, so please let your town leaders know any questions or follow-up comments.